

ADDRESSING THE 256K RAM
by Dave Hill

One of the most commonly asked questions lately has been, "How can I access the 256K RAM?". Now, through the efforts of both AERCO and Keith Watson, our added memory has become more than just a conversation piece. After numerous conversations with Keith, and some poking around on my own, I now present to you the method by which we are now able to access all of that RAM. I'll explain as best I can.

The 256K modification is available in 2 forms. For use with either 2 or 4 drives. Each configuration has a different port through which the extra memory can be accessed. There are two different trains of thought that could be used to refer to the extra memory.

- 1) Having a Home bank, a Dock bank, and 3 "shadow" Dock banks; each one being a "shadow" of the Dock bank.
- 2) Having a Home bank, and 4 "shadow" Dock banks; each one being a "shadow" of the Home bank.

Use whichever method is easiest for you to remember or to visualize. From here on out I will be referring to the extra memory as being 4 "shadow" Dock banks; each being a "shadow" of the Home bank.

To gain access to the additional banks of memory, use the addresses below that correspond to your particular system.

2 Drives		4 Drives	
OUT 60639,128	- 1st Shadow bank	- OUT 62687,128	
OUT 60639,132	- 2nd Shadow bank	- OUT 62687,129	
OUT 60639,136	- 3rd Shadow bank	- OUT 62687,136	
OUT 60639,140	- 4th Shadow bank	- OUT 62687,137	

THE 64K INTERFACE

The Dock bank is accessed from the Home bank via the HSR (the Horizontal Select Register, port 244). As an example, doing an OUT 244,240 would enable the upper 4 chunks (4-7) of the Dock bank in preference over those same chunks of the Home bank.

THE 256K INTERFACE

Now that we have 4 banks of 64K RAM instead of just 1, there are additional things that require our attention. The Dock bank we had available to us when all we had was the 64K version, is the same bank we now refer to as "shadow" Dock bank "128" in the 256K configuration. After the computer has been turned on, and the initialization is complete, the DOS (disc operating system) leaves us with chunk 0 (HSR=1 OUT 244,1) of "shadow" Dock bank "128" enabled. When we do an OUT 60639,n or OUT 62687,n, we are telling the computer which of the 4 "shadow" Dock banks is immediately available to the Home bank via the HSR (port 244). As an example, when we do an OUT 60639,136: OUT 244,240 (2 drive) or OUT 62687,136: OUT 244,240 (4 drive) we will be enabling the the upper 4 chunks of the 3rd "shadow" bank in preference over those same chunks of the Home bank.

As mentioned above, "shadow" bank "128" is selected by "default" each time the computer is turned on. The only time we will need to manually select "shadow" bank "128" is if we have previously enabled one of the other three "shadow" Dock banks. Unless told otherwise, the computer has no knowledge of the extra memory. The extra hardware decoding needed to access all 256K is provided on the interface. We simply need to inform the computer through software, the correct location where it can expect to find the extra RAM.

IMPORTANT ...

Remember, the "shadow" Dock bank that is currently accessible from the Home bank via the HSR is determined by the value last written to port 60639 (2 drive) or port 62687 (4 drive). Once one of the "shadow" Dock banks is enabled, the computer treats it as if it were the only Dock bank in memory. Also, it isn't possible say, to enable the upper 4 chunks of the 3rd "shadow" and the lower 4 chunks of the 2nd "shadow". Each "shadow" that is selected is only accessible from the Home bank, NOT from another "shadow". No more than one "shadow" bank is ever accessible at any one time from the Home bank via the HSR. By turning one "shadow" on, we are turning off the "shadow" that was previously enabled. The same thing applies to chunk enabling. By ENabling a chunk in one bank, the same chunk in the opposite bank is DISabled simultaneously. Anytime a different "shadow" bank is enabled, the current value of the HSR (port 244) will remain unchanged. Both the ports we are using (the HSR and the "shadow" port) operate independent of each other. Let's say we have chunks 0 and 7 enabled (OUT 244,129) of "shadow" Dock bank "128". If we were to switch to (enable) "shadow" Dock bank "136", we would still be reading chunks 0 and 7, only now we would be reading from a different "shadow".

As mentioned in "Chunk Enable Update" (Vol. 1,2,pg. 16), upon initialization, the lower 8K of the Home bank ROM and the contents of the 8K EPROM are block moved into the first 2 chunks (0 & 1 respectively) of the 1st "shadow" Dock bank (128). At this point the other 3 "shadow" Dock banks still contain no information. If "shadow" banks 2, 3, or 4 were enabled and we did an OUT 244,1 to access the disc, it would result in a system crash because the disc operating system is not there yet. We need to put it there ourselves.

To alleviate the potential crashing problems encountered when trying to access the disc from any "shadow" bank other than "128", Keith has written a routine that will copy the first 16K (chunks 0,1) of "shadow" Dock bank "128", into the first 16K of the other 3 "shadow" Dock banks.

Once that is accomplished, how do we keep track of which "shadow" Dock bank is enabled? The logical way would seem to be to "read" either port using PRINT IN 60639 or PRINT IN 62687 to find out which "shadow" Dock bank had been previously enabled. There is a catch though. Unlike port 244, where we can do a PRINT IN 244 and obtain the value last written to that port, doing the same to ports 60639 or 62687, the only result will be 255. Being unable to determine the current value of either port (60639 or 62687) by "reading" them (using IN,nn) we will need a way in which to keep track of which "shadow" bank is currently enabled. The method Keith has used is shown below.

- 1) OUT 60639,140 - Enable 4th shadow bank. (2 drive system)
OUT 62687,137 - " " " " (4 drive system)
- 2) OUT 244,1 - Enable chunk 0 of that bank.
- 3) POKE 37,140 (2 drive) - POKE address "37" with the
POKE 37,137 (4 drive) - "shadow" bank I.D.

NOTE: If you like, you could POKE 37 with 1, 2, 3 and 4. Home bank will always contain a 0 at address 37. Use whichever is easier for you to keep track of.

To determine which of the "shadow" banks is currently enabled, run the program below, then be sure that chunk 0 (OUT 244,1 or any combination of chunks which will include chunk 0) is enabled and PRINT PEEK 37. That is where we will find the current bank I.D. number.

To load and save information from any one of the extra banks of memory, I would recommend you read the article from Vol. 1, 2 on "Basic in the Dock bank". Refer to the portion of that article at the bottom of page 4 entitled "Saving and loading programs in the Dock bank". Just a quick reminder. The contents of the HSR (port 244) are saved to disc along with all .BINary programs. So if we are in one of the "shadow" Dock banks and load in a .BINary program which was saved from the Home bank, the computer will switch to the Home bank and load in the program. All .BINary programs will load back into the same chunks they were saved from and will also enable any other chunks of memory that were enabled at the time they were saved.

were enabled at this time the program was saved to disc.

It may also be helpful to read the article on page 16 entitled "Chunk Enable Update" also from Vol. 1, 2. A reminder once again. Once we have enabled any one of the "shadow" Dock banks, the computer treats it as if were the only one in existence. So the technique that worked for saving and loading from the Dock bank with the 64K system will work the equally as well from any "shadow" bank in the 256K system. When loading in a .BINary program, other than the normal header information, the computer will only be concerned with which chunks were enabled when it was saved (contents of the HSR) and seeing to it that it loads back where it came from. At the time of loading, the computer doesn't pay any attention to which "shadow" is enabled, only chunks.

Below are 2 Basic programs which will enable access to the extra memory. One program is for 2 drive setups and the other for 4 drives.